SONY International (Europe) GmbH
S30107US

Linker Molecules for Selective Metallisation of Nucleic Acids and Their Uses

---

CLAIMS

1. A linker molecule, comprising
one or more nucleic acid binding group(s) and one or more nanoparticle binding group(s) which are connected covalently by a spacer group.

2. A linker molecule according to claim 1, wherein said nucleic acid binding group is selected from the group of agents comprising intercalating agents, groove-binding agents, alkylating agents, and combinations thereof.

3. A linker molecule according to claim 2, wherein the intercalating agent is selected from the group of compounds comprising acridines, anthraquinones, diazapyrenium derivatives, furanocoumarins (psoralens), naphthalene diimides, naphthalene mono-imides, phenanthridines, porphyrins, and metal coordination complexes containing planar, aromatic ligands (metallointercalators).

4. A linker molecule according to claim 2, wherein the groove-binding agent is selected from the group of compounds comprising bis-benzamidines, bis-benzimidazoles, lexi-tropsins, perylene diimides, phenylbenzimidazoles, porphyrins, pyrrole oligopeptides and viologens.

5. A linker molecule according to claim 2, wherein the alkylating agent is selected from the group of compounds comprising aziridines, 2-chloroethane derivatives, epoxides, nitrogen mustards, sulfur mustards and metal coordination complexes having at least one leaving group ligand.

6. A linker molecule according to claim 5, wherein the metal coordination complexes that are alkylating agents are selected form the group of complexes comprising Pt^{2+},

Pt^{4+}, Pd^{2+}, Ru^{2+}, Ru^{3+}, Rh^{1+}, Rh^{2+}, and Rh^{3+} having at least one ligand selected from the group comprising halide, water, di(alkyl)sulfoxide, nitrate, sulfate, carboxylate, substituted carboxylate, carbonate, phosphate, nitrite, sulfite, and hydroxide.

7. A linker molecule according to claim 1, wherein the nanoparticle binding group forms covalent bonds with surface ligands on the nanoparticle or displaces existing surface ligands on the nanoparticle, or combinations thereof.

8. A linker molecule according to claim 1 or 7, wherein the nanoparticle binding group comprises at least one covalent bond forming functional group selected from carboxylic acids and derivatives thereof, sulfonic acids and derivatives thereof, amines, alcohols, thiols, aldehydes, ketones, isocyanates, isothiocyanates, ethers, and halides.

9. A linker molecule according to claim 1 or 7, wherein the nanoparticle binding group comprises at least one metal-binding group selected from amines, phosphines, thiols, disulfides, dithiocarbamates, dithiophosphates, dithiophosphonates, thioethers, thiosulfates, and thioureas.

10. A method for the manufacture of a nanoparticle comprising conjugate, wherein a nanoparticle is combined with a linker molecule according to any of claims 1 to 9, forming a nanoparticle/linker conjugate.

11. A method for the manufacture of a nanoparticle-nucleic acid composite, wherein the nanoparticle/linker conjugate according to claim 10 is further reacted with a nucleic acid, forming a nanoparticle-nucleic acid composite.

12. A method for the manufacture of a nucleic acid comprising conjugate, wherein a nucleic acid molecule is reacted with a linker molecule according to any of claims 1 to 9, forming a nucleic acid/linker conjugate.

13. A method for the manufacture of a nanoparticle-nucleic acid composite, wherein the nucleic acid/linker conjugate according to claim 12 is further reacted with a nanoparticle, forming a nanoparticle-nucleic acid composite.

14. A method according to any of claims 11 to 13, characterized in that the nucleic acid is present dissolved in solution, preferably in an aqueous solution or immobilized on a substrate, preferably a non-metallic substrate or an electrode structure.

15. A method according to any of claims 11 to 14, characterized in that the nucleic acid is selected from the group comprising natural, modified, synthetic, and recombinant nucleic acids, DNA, RNA, PNA, CNA, oligonucleotides, oligonucleotides of DNA, oligonucleotides of RNA, primers, A-DNA, B-DNA, Z-DNA, polynucleotides of DNA, polynucleotides of RNA, T-junctions of nucleic acids, triplexes of nucleic acids, quadruplexes of nucleic acids, domains of non-nucleic acid polymer-nucleic acid blockcopolymers and combinations thereof.

16. A method according to any of claims 11 to 15, characterized in that the nucleic acid is double-stranded or single-stranded.

17. A method according to any of claims 10, 11 or 13, characterized in that the nanoparticle is catalytically active towards electroless plating

18. A method according to any of claims 10, 11, 13 or 17, characterized in that the nanoparticle contains a metal selected from the group comprising Fe, Co, Ni, Cu, Ru, Rh, Pd, Os, Ir, Pt, Ag, Au and combinations (e. g. alloys) of these metals.

19. A method according to any of claims 10, 11, 13, 17 or 18, characterized in that the nanoparticle's size is less than 10 nm.

20. A method according to claim 19, characterized in that the nanoparticle's size is between about 0.5 nm and about 3 nm.

21. A nanoparticle/linker conjugate or nucleic acid/linker conjugate obtainable according to a method of any of claims 10, 12, and 14 to 20.

22. A nanoparticle-nucleic acid composite obtainable according to a method of any of claims 11, 13, and 14 to 20.

23. A method for the manufacture of a nanowire, comprising electroless deposition of a metal onto a nanoparticle-nucleic acid composite according to claim 22.

24. A method according to claim 23, characterized in that the nanoparticle-nucleic acid composite is present dissolved in solution, preferably in an aqueous solution or immobilized on a substrate, preferably a non-metallic substrate or an electrode structure.

25. A method according to claim 23 or 24, characterized in that the metal deposited by electroless plating is selected from the group comprising Fe, Co, Ni, Cu, Ru, Rh, Pd, Os, Ir, Pt, Ag, Au and combinations (e. g. alloys) of these metals and magnetic and/or magnetized Fe, Co, Ni, and combinations (e. g. alloys) of these metals, and combinations (e. g. alloys) of these metals with B or P.

26. Nanowire obtainable by a method according to any of claims 23 to 25.

27. An electronic network comprising at least one nanowire according to claim 26.

28. An electronic circuit comprising an electronic network according to claim 27.

29. A junction between two or more wires of an electronic circuit, wherein each of the wires have an end segment proximal to the junction comprising a nanowire according to claim 26.

30. Use of the method according to any of claims 10 to 20 for selective metallisation of a nucleic acid.